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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/721,713	11/25/2003	Ioana M. Boier-Martin	YOR920030614US1	6291

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EXAMINER	
CRAIG, DWIN M	

ART UNIT	PAPER NUMBER
2123	

DATE MAILED: 11/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/721,713	BOIER-MARTIN ET AL.	
	Examiner	Art Unit	
	Dwin M. Craig	2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 November 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17* is/are rejected.

7)☒ Claim(s) *16* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *25 November 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *11/25/03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-17 have been presented for examination.

2. The information disclosure statement filed 11/25/2003 fails to comply with the provisions of 37 CFR 1.97, 1.98 and MPEP § 609, because reference AH lacks a publication date on the actual copy. It has been placed in the application file but the information referred to therein has not been considered as to the merits. Applicant is advised that the date of any resubmission of any missing element(s) will be the date of submission for purposes of determining compliance with the requirements based on the time of filing the statement, including all certification requirements for statements under 37 CFR 1.97(e). See MPEP § 609,¶ C(1). The other references in this IDS have been fully considered by the examiner.

Claim Objections

3. Claim 16 is objected to because of the following informalities: The word *"re-parameterizating"* is not a word in current usage in the English language. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 1-17 rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

As regards independent claims 1, 2, 7, 16 & 17 it is unclear if an artisan of ordinary skill could make or use the described method without undue experimentation, more specifically, it is unclear what the constraints and limits are on the *natural spacing* that occurs as the lines of the *Catmull-Clark* model approach the *extraordinary vertex* as expressly disclosed in Applicants' claimed limitations.

Clarification and amendment are required.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4.1 Claims 3 & 4 recite the limitation "the derivatives evaluated at one or more parameter values" in the first line(s) of claims 3 & 4. There is insufficient antecedent basis for this limitation in the claim.

4.2 Claim 7 recites the limitation "the subdivision surfaces" in the 5th line of the claim. There is insufficient antecedent basis for this limitation in the claim.

4.3 Claims 1-17 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

More specifically, it is unclear as to what are the *metes and bounds* of the following expressly claimed limitations; *iso-parameter lines* and *natural spacing*. It is unclear from

Applicants' specification if *natural spacing* is referring to *natural re-parameterization* or has another meaning, like the distance that occurs as the lines of the *Catmull-Clark* model approach the *extraordinary vertex,* the only reference to the specific phrase *"natural spacing"* in Applicants' instant application is in the summary of the invention and the examiner has been unable to find a specific definition in the specification which would provide the clarity and precision required by 35 USC 112 2nd paragraph. As regards the phrase *"iso-parameter lines"* the specification points to the lines in figures 12A thru 12C and yet is silent as to the specific definition of *iso-parameter line* such that the specific *metes and bounds* of this claimed limitation are provided with the required clarity and precision, see also MPEP 2111.01 Plain Meaning.

Clarification and/or amendment are required.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

5. Claims 1-17 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

5.1 As regards independent claims 1, 2 & 7, the current claim language fails to teach a *useful concrete and tangible result* as required by 35 USC § 101, more specifically, the current claim language is directed towards the description of a change of a model, which is merely an manipulation of an abstraction and is therefore not directed towards a change in any tangibly embodied item in the *"real-world"*, further the current claim language discloses merely

mathematical operations and is therefore directed towards mere manipulation of an abstraction, see MPEP 2106.02. As a further example, independent claim 7, expressly claims, *"A method for surface re-parameterization of a surface around extraordinary vertices of a computer three-dimensional Catmull-Clark model..."* the claimed *surface* is not an actual surface in the real world but a mathematical construct and *re-parameterization* is merely changing the values of variables in a formula which is using a mathematical algorithm.

Amendment is required.

5.2 As regards independent claim 16, the current claim language claims *a system* and while the examiner recognizes that Applicants' are invoking structural support from the specification by using the *means for* clause, the current claim language is ambiguous as to the actual components of said system. Further, the claim language is teaching manipulation of an abstraction which is a mathematical construct, for example, *"means for re-parameterizating of one or more subdivision surfaces of the Catmull-Clark model..."* the claimed model is an abstraction the subdivision surfaces are abstractions, there is not manipulation of anything in the *real-world*. See MPEP 2106.02. Finally, there the current claim language fails to teach or disclose *a useful, concrete or tangible result* as required by 35 USC § 101.

Amendment is required.

5.3 As regards independent claim 17, the current claim language describes *software*, software *per se* is not statutory subject matter, see MPEP 2106.01 FUNCTIONAL DESCRIPTIVE MATERIAL: "DATA STRUCTURES" REPRESENTING DESCRIPTIVE MATERIAL *PER SE* OR COMPUTER PROGRAMS REPRESENTING COMPUTER LISTINGS *PER SE* and Warmerdam, 33 F.3d at 1361, 31 USPQ2d at 1760.

Further, the current claim language discloses manipulation of an abstraction, *see the arguments presented regarding independent claims 1, 2, 7, & 16,* and see also MPEP 2106.02. The current claim language also fails to disclose a *useful, concrete and tangible result* as required by 35 USC § 101.

Amendment is required.

5.4 Dependent claims 3-6 and 8-15 have not provided remedy in regards to 35 USC § 101 and stand rejected for the same reasons presented.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1-8 and 10-17 are rejected under 35 USC 102(b) as being unpatentable over "Cut-and-Paste Editing of Multiresolutioon Surfaces" by Henning Biermann, Ioana Martin, Fausto Bernardi and Denis Zorin, hereafter referred to as *Biermann et al.*

6.1 As regards independent claims 1, 2, 7, 16 & 17 and using independent claim 1 as an example, *Beirmann et al.* discloses, *a three dimensional model re-parameterization computer system comprising: a re-parameterization process that re-parameterizes one or more Catmull-Clark models to create a re-parameterized model, each of the Catmull-Clark models having one or more extraordinary vertices...*

See page 314, section 3.2 Multiresolution Subdivision Surfaces, in the descriptive text where is disclosed,

The representation that we use was introduced in various forms in [28, 38, 45]. Subdivision defines a smooth surface recursively as the limit of a sequence of meshes.1 Each finer mesh is obtained from a coarse mesh by using a set of fixed refinement rules, e.g., Loop [27] or Catmull-Clark [6] subdivision rules. In our implementation we use Catmull-Clark rules. Multiresolution surfaces extend subdivision surfaces by introducing *details* at each level. Each time a finer mesh is computed, it is obtained by adding detail offsets to the subdivided coarse mesh. If we are given a *semi-regular mesh*, i.e., a mesh with subdivision connectivity, we can easily convert it to a multiresolution surface if we define a smoothing operation to compute vertices on a coarse level from a finer level. The details are then computed as differences between levels (see Section 5).

As regards the limitation teaching, *re-parameterization process...*

See page 314...

We believe that, in all cases when surface data is extensively modified, conversion is the best approach, as reparameterization is almost inevitable if the surface is texture-mapped. Gu et al. provide a detailed study of the benefits of a conversion to a similar representation (i.e., the geometric image [12]).

As regards the limitation teaching, *extraordinary vertices...*

See page 316...

Angle-based flattening. For a given mesh a parameterization is defined by specifying the positions (parametric coordinates) of all vertices of the mesh in the plane. Without the loss of generality, we can assume a triangular mesh (we use quad subdivision surfaces, but each quad can be easily split into two triangles). The idea of angle-based flattening is to compute the parametric coordinates of the vertices indirectly: first, all angles are computed using an optimization procedure, then the planar mesh is reconstructed by fixing the length of one of the edges. The reason for computing the angles rather than vertex positions directly is that the one-to-one condition can be easily enforced and aspect ratios can be controlled explicitly. The disadvantage is that the reconstruction procedure is relatively unstable, as positions of vertices depend sequentially on each other. However, we found that for the relatively small numbers of triangles that we use (at most thousands), this is never a problem.

The Examiner notes that the *vertices in the mesh plane* are functionally equivalent to the claimed *extraordinary vertices.*

As regards the limitations further disclosed *Biermann et al.* discloses, *and one or more adjacent iso-parameter lines that have a natural spacing that changes, the re-parameterized model having iso-parameter lines with a new spacing that is different than the natural spacing as the lines approach the extraordinary vertex.*

See page 314 and section 3.3 Pasting with an Intermediate plane, and

A direct construction of the pasting mapping is difficult to achieve efficiently. Visual smoothness and minimization of distortion are typically obtained by minimizing appropriate functionals. In the case of a direct mapping of the source region to the target surface domain the values of the mapping are not a part of any affine space. Indeed, the domain of the surface is a collection of faces of the coarse-level control mesh, so each point needs to be characterized as where is the face id, and are coordinates within

the face. Unless the whole surface can be reparameterized on a plane, there is no simple way to compute linear combinations of two arbitrary points (e.g., the midpoint of the interval connecting the points), which makes the application of most common computational techniques very difficult. Even a simple operation such as computing angles of a triangle given three vertices becomes a complicated task, an important consideration for the angle-based flattening technique we consider.

To avoid these difficulties, we parameterize the corresponding areas of the source and target over the plane. The idea is to map each surface onto the plane as *isometrically* as possible and then align the two planar parameterizations, using a linear transformation to compensate for the first-order distortion. In this case, the pasting map is restricted to a simple class of maps (i.e., linear transformations, see Figure 2), but new parameterizations and are constructed for the parts of surfaces of interest for every pastingoperation.

See also the figure 3 on the same page entitled *"Natural parameterization of the subdivision surface.* The examiner further notes that the spacing of the *iso-parameter lines* in figure 3 and figure 5 on page 315 appear to have natural spacing.

See also page 315, section 4, Overview of the Algorithm.

6.2 As regards dependent claims 3 & 4, *Biermann et al.* discloses, *where the derivatives evaluated at one or more parameter values of one or more limit surfaces of subdivision of the Catmull-Clark model approach zero as one or more parameter positions approach the extraordinary vertex.*

See page 315, more specifically...

The region in the interior of the feature is assigned alpha values 1 and all vertices outside the region are given values 0.

See also...

Without the loss of generality, we can assume a triangular mesh (we use quad *subdivision surfaces*, but each quad can be easily split into two triangles)

6.3 As regards dependent claim 5, *Biermann et al.* discloses, *where the new spacing decreases as the iso-parameter lines approach one or more of the extraordinary vertices.*

Page 318 in Figure 9 the spacing appears to be decreasing.

6.4 As regards dependent claim 6, *Biermann et al.* discloses, *where the new spacing is uniform as the iso-parameter lines approach one or more of the extraordinary vertices.*

Page 318 in Figure 9 the spacing appears to be uniform and the lines are approaching the vertices.

6.5 As regards dependent claim 8, *Biermann et al.* discloses, *further comprising the step of evaluating the re-parameterized surface at one or more parameter positions.*

See page 316 the section entitled Angle-Based Flatening,

For a given mesh a parameterization is defined by specifying the positions (parametric coordinates) of all vertices of the mesh in the plane. Without the loss of generality, we can assume a triangular mesh (we use quad subdivision surfaces, but each quad can be easily split into two triangles). The idea of angle-based flattening is to compute the parametric coordinates of the vertices indirectly: first, all angles are computed using an optimization procedure, then the planar mesh is reconstructed by fixing the length of one of the edges.

6.6 As regards dependent claim 10, *Biermann et al.* discloses, *where the re-parameterizing comprises the following steps: computing a characteristic map corresponding to each of the vertices of a face, being face vertices, of a quadrilateral mesh containing one or more points being evaluated; computing an inverse characteristic map for each of the face vertices; and blending the inverse characteristic maps of the four face vertices to create the re-parameterization.*

See the description on pages 316 & 317 on page 319 see also the section on Mapping and resampleing as regards the four face vertices and the quadrilateral mesh.

6.7 As regards dependent claim 11, *Biermann et al.* discloses, *where the characteristic map is used to obtain a continuously differentiable parameterization around one or more of the extraordinary vertices.*

Page 314 figure 3 appears to teach *differentiable parameterization around one or more of the extraordinary vertices.* See also Figures 8 & 9 and the descriptive text for the figures. Further

it should be noted and in regards to Figures 8 & 9 is that the convergence of the lines to specific points more particularly the figures labeled, radial parameterization and spine parameterization appear to show continuous differentiable parameterization.

6.8 As regards dependent claim 12, *Biermann et al.* discloses, *where the inverse characteristic map is computed by locating a layer on the surface and a polynomial patch within that layer that contains the point to be evaluated and then computing a re-parametrized position of the input point by polynomial patch inversion.*

Page 316, in the section entitled Parameterization...

Parameterization is needed both for the source and target base surfaces. The type of *surface patches* that we need to parameterize is relatively uncommon: while the surface is likely to be quite smooth, the shape of the patch can be relatively complex. The parameterization we construct should satisfy the following requirements:

The parameterization region should not be chosen a priori. The need for this can be seen from the following simple example: the outline of a feature selected on the plane base surface can be arbitrarily complex, however the parameterization should not be different from the surface itself. Any algorithm that requires a fixed domain is not likely to perform well in this situation. The parameterization should be guaranteed to be one-to-one. As we need to resample, for each vertex on the target we need to identify a unique position on the source. This means that at least the map from the source to the plane has to be one-to-one. The parameterization should minimize a reasonable measure of distortion. Ideally, for developable surfaces it should be an isometry up to a scale factor.

The algorithm that we use does not explicitly minimize a measure, but it appears to produce results with close to minimal shape distortion, as discussed below. It tends to produce better results than all other algorithms that we have tried in situations relevant for us.

6.10 As regards dependent claim 13 *Biermann et al.* discloses, *where the blending is a blending of the re-parameterizations of two or more extraordinary vertices.*

See the discussion of boundary constraints on page 316.

6.11 As regards dependent claim 14, *Biermann et al.* discloses, *where the new spacing decreases as the iso-parameter lines approach one or more of the extraordinary vertices.*

See figure 8 and the accompanying descriptive text regarding the spacing that decreases as the line converge in the radial parameterization.

6.12 As regards dependent claim 15, *Biermann et al.* discloses, *where the new spacing is uniform as the iso-parameter lines approach one or more of the extraordinary vertices.*

See figure 8 and the accompanying descriptive text regarding the spacing that decreases as the line converge in the radial parameterization.

Allowable Subject Matter

7. Any indication of allowability of the claims rejected under 35 USC 112 2nd paragraph, but not on prior art is being held in abeyance pending the manner in which applicant amends or responds to this rejection under 35 U.S.C. 112 2nd paragraph.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dwin M. Craig whose telephone number is (571) 272-3710. The examiner can normally be reached on 10:00 - 6:00 M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul L. Rodriguez can be reached on (571) 272-3753. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Dwin McTaggart Craig

11/13/04

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